Section I. (Amendments to the Claims)

Please cancel claim 63, amend claims 38, 56, 59, 60, 62 and 64 and add new claims 65-69 as set out below in the following listing of pending claims 38-60, 62 and 64-69.

1-37. (Canceled)

38. (Currently amended) A method of fabricating a ferroelectric PZT film on a substrate, comprising selecting MOCVD conditions for producing a ferroelectric PZT material, and forming the film by liquid delivery MOCVD on the substrate under said MOCVD conditions for producing ~~a~~ said ferroelectric PZT material, wherein said selecting MOCVD conditions comprises:

establishing a correlative empirical matrix of plots of each of ferroelectric polarization, leakage current density, and atomic percent lead in PZT films, as a function of each of temperature, pressure and liquid precursor solution A/B ratio, wherein A/B ratio is the ratio of Pb to (Zr + Ti);

identifying from said plots an inflection point of each plot as defining a region of operation with respect to independent process variables of temperature, pressure and liquid precursor solution A/B ratio; and

conducting the liquid delivery MOCVD at temperature, pressure and liquid precursor solution A/B ratio values selected from said region of operation

~~having at least one scalable character selected from the group consisting of dimensionally scalable character, pulse length scalable character and E field scalable character, and wherein said PZT material has at least one property selected from the group consisting of having a thickness from about 20 to about 150 nanometers, having a ferroelectric operating voltage below 2 Volts, having at least one Type 1 properties and having at least one Type 2 properties~~.

39. (Original) The method of claim 38, wherein the MOCVD conditions include use of a lead source reagent selected from the group consisting of $Pb(thd)_2$ and $Pb(thd)_2pmdeta$.

40. (Original) The method of claim 38, wherein the MOCVD conditions include use of a zirconium source reagent selected from the group consisting of $Zr(thd)_4$ and $Zr(O\text{-}i\text{-}Pr)_2(thd)_2$.

41. (Original) The method of claim 38, wherein the MOCVD conditions include use of $Ti(O\text{-}i\text{-}Pr)_2(thd)_2$ as a titanium source reagent.

42. (Original) The method of claim 38, wherein the MOCVD conditions include use of $Pb(thd)_2$, $Ti(O\text{-}i\text{-}Pr)_2(thd)_2$ and $Zr(thd)_4$ as respective lead, titanium and zirconium source reagents.

43. (Original) The method of claim 38, wherein the MOCVD conditions include use of $Pb(thd)_2pmdeta$, $Ti(O\text{-}i\text{-}Pr)_2(thd)_2$ and $Zr(thd)_4$ as respective lead, titanium and zirconium source reagents.

44. (Original) The method of claim 38, wherein the MOCVD conditions include use of $Pb(thd)_2pmdeta$, $Ti(O\text{-}i\text{-}Pr)_2(thd)_2$ and $Zr(O\text{-}i\text{-}Pr)_2(thd)_2$ as respective lead, titanium and zirconium source reagents.

45. (Original) The method of claim 38, wherein the source reagents are provided for liquid delivery MOCVD in a solvent medium comprising one or more solvent species selected from the group consisting of: tetrahydrofuran, glyme solvents, alcohols, hydrocarbon solvents, hydroaryl solvents, amines, polyamines, and mixtures of two or more of the foregoing.

46. (Original) The method of claim 38, wherein the source reagents are provided for liquid delivery

MOCVD in a solvent medium comprising tetrahydrofuran: isopropanol: tetraglyme in an 8:2:1 volume ratio.

47. (Original) The method of claim 38, wherein the source reagents are provided for liquid delivery MOCVD in a solvent medium comprising octane: decane: polyamine in a 5:4:1 volume ratio.

48. (Original) The method of claim 38, wherein the source reagents are provided for liquid delivery MOCVD in a solvent medium comprising octane: polyamine in a 9:1 volume ratio.

49. (Original) The method of claim 38, wherein the source reagents are provided for liquid delivery MOCVD in a solvent medium comprising tetrahydrofuran.

50. (Original) The method of claim 38, wherein the substrate comprises a noble metal.

51. (Original) The method of claim 38, wherein the substrate comprises a noble metal selected from the group consisting of iridium, platinum, and combinations thereof.

52. (Original) The method of claim 38, wherein the substrate comprises a TiAlN barrier layer overlaid by an iridium layer.

53. (Original) The method of claim 38, wherein the liquid delivery MOCVD includes vaporization of a source reagent solution to form precursor vapor therefrom and flowing the precursor vapor to a CVD chamber in a carrier gas.

54. (Original) The method of claim 53, wherein the carrier gas is selected from the group consisting of argon, helium and mixtures thereof.

55. (Original) The method according to claim 38, further comprising flowing to the CVD chamber an oxidant medium including at least one species selected from the group consisting of O_2, O_3, N_2O, and O_2/N_2O.

56. (Currently amended) A method of fabricating a ferroelectric PZT film on a substrate, comprising selecting MOCVD conditions including nucleation conditions producing a ferroelectric PZT material, and forming the film by liquid delivery MOCVD on the substrate under said MOCVD conditions, wherein said selecting MOCVD conditions comprises:

establishing a correlative empirical matrix of plots of each of ferroelectric polarization, leakage current density, and atomic percent lead in PZT films, as a function of each of temperature, pressure and liquid precursor solution A/B ratio, wherein A/B ratio is the ratio of Pb to (Zr + Ti);

identifying from said plots an inflection point of each plot as defining a region of operation with respect to independent process variables of temperature, pressure and liquid precursor solution A/B ratio; and

conducting the liquid delivery MOCVD at temperature, pressure and liquid precursor solution A/B ratio values selected from said region of operation

~~including nucleation conditions producing a ferroelectric PZT material having at least one scalable character selected from the group consisting of dimensionally scalable character, pulse length scalable character and E field scalable character, and wherein said PZT material has at least one property selected from the group consisting of having a thickness from about 20 to about 150 nanometers, having a ferroelectric operating voltage below 2 Volts, having at least one Type 1 properties and having at least one Type 2 properties~~.

57. (Original) A method of fabricating a ferroelectric PZT film on a substrate, comprising forming the film by liquid delivery MOCVD on the substrate under MOCVD conditions including temperature, pressure and liquid precursor solution A/B ratio determined by plateau effect determination from a correlative empirical matrix of plots of each of ferroelectric polarization, leakage current density and atomic percent lead in PZT films, as a function of each of temperature, pressure and liquid precursor solution A/B ratio, wherein A/B ratio is the ratio of Pb to (Zr + Ti).

58. (Previously presented) A method of fabricating a ferroelectric PZT film on a substrate, comprising forming the film by liquid delivery MOCVD on the substrate under MOCVD conditions including temperature, pressure and liquid precursor solution A/B ratio determined by plateau effect determination from a correlative empirical matrix of plots of each of ferroelectric polarization, leakage current density and atomic percent lead in PZT films, as a function of each of temperature, pressure and liquid precursor solution A/B ratio, wherein A/B ratio is the ratio of Pb to (Zr + Ti), and wherein said ferroelectric PZT film comprises a ferroelectric PZT material having at least one scalable character selected from the group consisting of dimensionally scalable character, pulse length scalable character and E-field scalable character, and wherein said PZT material has at least one property selected from the group consisting of having a thickness from about 20 to about 150 nanometers, having a ferroelectric operating voltage below 2 Volts, having at least one Type 1 properties and having at least one Type 2 properties.

59. (Currently amended) A method of fabricating a ferroelectric PZT film on a substrate, comprising forming the film by liquid delivery MOCVD on the substrate under MOCVD conditions including Correlative Materials or Processing Requirements, to yield a ferroelectric PZT film having PZT Properties <u>of ferroelectric polarization, leakage current density, dielectric relaxation,</u>

retention, avoidance of cycling fatigue, e-field scalability, surface smoothness, and grain size, wherein said Correlative Materials or Processing Requirements and PZT Properties comprise:

PZT Properties	**Correlative Materials or Processing Requirements**
Basic properties:	
Ferroelectric polarization $P_{sw} > 20\ \mu C/cm^2$	Film Pb concentration > threshold level~~;~~ and operation on A/B plateau above the knee region, and with temperature, pressure and gas phase A/B concentration ratio defined by plateau effect determination,
Leakage current density $J < 10^{-5}\ A/cm^2$ at operating voltage	Film Pb concentration within a range (between the minimum and maximum) on the A/B plateau, and with temperature, pressure and gas phase A/B concentration ratio defined by plateau effect determination,
Dielectric relaxation For characteristic J^{-n} ~~∝~~ log (time, ns), n > 0.5 and J < 1% ferroelectric switching current (A) from time = 0-100 ns.	Zr/Ti ratio < 45/55 and Deposition P > 1.8 torr,
Retention Maintenance of ferroelectric properties (ferroelectric domains)	Operation within ranges of temperature, pressure and gas phase A/B concentration ratio defined by plateau effect determination,
Avoidance of cycling fatigue P_{sw} < 10% decrease after 10^{10} cycles	Use of Ir-based electrodes,
E-field scalability	Operation within ranges of temperature, pressure and gas phase A/B concentration ratio defined by plateau effect determination,
Surface smoothness	Nucleation-growth conditions during film formation within ranges of temperature, pressure and gas phase A/B concentration ratio defined by plateau effect determination, and

Grain size	Nucleation-growth conditions during film formation within ranges of temperature, pressure and gas phase A/B concentration ratio defined by plateau effect determination.

60. (Currently amended) A method of fabricating a FeRAM device, comprising selecting MOCVD conditions producing a ferroelectric PZT material, and forming a capacitor on a substrate including a ferroelectric PZT material ~~having at least one scalable character selected from the group consisting of dimensionally scalable character, pulse length scalable character and E field scalable character, and wherein said PZT material has at least one property selected from the group consisting of having a thickness from about 20 to about 150 nanometers, having a ferroelectric operating voltage below 2 Volts, having at least one Type 1 properties and having at least one Type 2 properties~~, wherein the ferroelectric PZT material is deposited by liquid delivery MOCVD under said MOCVD conditions yielding said ferroelectric PZT material, wherein said selecting MOCVD conditions comprises:

establishing a correlative empirical matrix of plots of each of ferroelectric polarization, leakage current density, and atomic percent lead in PZT films, as a function of each of temperature, pressure and liquid precursor solution A/B ratio, wherein A/B ratio is the ratio of Pb to (Zr + Ti);

identifying from said plots an inflection point of each plot as defining a region of operation with respect to independent process variables of temperature, pressure and liquid precursor solution A/B ratio; and

conducting the liquid delivery MOCVD at temperature, pressure and liquid precursor solution A/B ratio values selected from said region of operation.

61. (Canceled)

62. (Currently amended) The method of claim 60, wherein the PZT film defines a capacitor area of from about 10^4 μm^2 to about 10^{-2} μm^2.

63. (Cancelled)

64. (Currently amended) The method of claim 60, wherein the MOCVD conditions comprise Correlative Materials or Processing Requirements, to yield a ferroelectric PZT film having PZT Properties of ferroelectric polarization, leakage current density, dielectric relaxation, retention, avoidance of cycling fatigue, e-field scalability, surface smoothness, and grain size, wherein said Correlative Materials or Processing Requirements and PZT Properties comprise:

PZT Properties	**Correlative Materials or Processing Requirements**
Basic properties:	
Ferroelectric polarization $P_{sw} > 20\ \mu C/cm^2$	Film Pb concentration > threshold level~~;~~ and operation on A/B plateau above the knee region, and with temperature, pressure and gas phase A/B concentration ratio defined by plateau effect determination;
Leakage current density $J < 10^{-5}\ A/cm^2$ at operating voltage	Film Pb concentration within a range (between the minimum and maximum) on the A/B plateau, and with temperature, pressure and gas phase A/B concentration ratio defined by plateau effect determination;
Dielectric relaxation For characteristic J^{-n} ~~∝~~ log (time, ns), n > 0.5 and J < 1% ferroelectric switching current (A) from time = 0-100 ns.	Zr/Ti ratio < 45/55 and Deposition P > 1.8 torr;
Retention	Operation within ranges of temperature, pressure

Maintenance of ferroelectric properties (ferroelectric domains)	and gas phase A/B concentration ratio defined by plateau effect determination;
Avoidance of cycling fatigue P_{sw} < 10% decrease after 10^{10} cycles	Use of Ir-based electrodes;
E-field scalability	Operation within ranges of temperature, pressure and gas phase A/B concentration ratio defined by plateau effect determination;
Surface smoothness	Nucleation-growth conditions during film formation within ranges of temperature, pressure and gas phase A/B concentration ratio defined by plateau effect determination; and
Grain size	Nucleation-growth conditions during film formation within ranges of temperature, pressure and gas phase A/B concentration ratio defined by plateau effect determination.

65. (New) The method of claim 38, wherein said MOCVD conditions comprise temperature in a range from about 400°C to about 1200°C, pressure in a range from about 0.1 to about 760 torr, and liquid precursor solution A/B ratio in a range of from about 0.52 to about 1.52.

66. (New) The method of claim 38, wherein said ferroelectric PZT film has a ferroelectric polarization of greater than 20 $\mu C/cm^2$.

67. (New) The method of claim 66, wherein said ferroelectric PZT film has a leakage current density of less than 10^{-4} A/cm^2.

68. (New) The method of claim 67, wherein said ferroelectric PZT film has an atomic percent lead in a range of from about 49.43% to about 55%.

69. (New) A method comprising:

conducting a plateau effect determination to determine MOCVD process conditions; and

depositing film forming material on a substrate under said MOCVD process conditions.